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PROVISIONAL INTELLIGENCE REPORT

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NICKEL SUPPLY IN THE SOVIET BLOC

CIA/RR PR-57
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PROVISIONAL INTELLIGENCE REPORT

NICKEL SUPPLY IN THE SOVIET BLOC

CIA/RR PR-57

(ORR Project 23.174)

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Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

CONTENTS

Appendixes

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Tables

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Map

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

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(ORR Project 23.174)

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NICKEL SUPPLY IN THE SOVIET BLOC*

Summary

In the USSR as in the US, nickel is essential in the manufacture of jet engines and armaments and in the atomic energy program, as well as in many other industries necessary for the support of a defense program. Although there are several substitute possibilities for which the USSR is qualified with the requisite raw materials, much of the research in the field of substitution of metals remains to be put into practice by Soviet industry.

The USSR possesses a minimum of 800,000 metric tons** of nickel reserves, which at the present rate of consumption will last from 15 to 20 years. Included in this estimate is the important deposit at Pechenga, acquired by the USSR from Finland in 1944.

At the present time the USSR is the second largest nickel producer in the world. Production in 1953 is estimated at 42,000 tons, which is about one-third of the Canadian production. The expansion of the nickel production facilities is under way and will make possible the 1955 planned production of 49,000 tons. A stockpile of 21,000 tons had been accumulated by 1950 and may have increased by 1953. Relative to the size of its economy, the Soviet nickel supply compares favorably with that of the US.

Although there are small nickel deposits in Czechoslovakia, East Germany, Poland, Communist China, and North Korea, there are processing facilities only in East Germany and Poland. In 1953, Poland produced 600 tons, East Germany 200 tons. The planned production for East Germany in 1955 is 1,500 tons, and the fulfillment of this plan seems probable.

* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 1 April 1954.
** Tonnages are given in metric tons of metallic nickel throughout this report.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Production in the Satellites is inadequate for the demand, and imports from both the USSR and the West have been necessary. The COCOM embargo has helped to create a deficiency of nickel in the Satellites, and the increased imports from the USSR have caused a drain on Soviet production.

I. Introduction.

Nickel imparts such properties as deep hardening, improved toughness at low temperatures, and corrosion resistance to alloy steels. It helps jet engines to perform at high temperatures, and it provides magnetic properties for electronic components. In addition to its direct military uses, nickel is an essential alloy particularly in the oil, chemical, power, electrical, transportation, and metalworking industries, as well as in the development of atomic energy.

The forms, in broad categories, in which nickel was used in the USSR in 1945, 1/* are shown in Table 1.** A comparison with US practice in the same year, when each country was on a wartime basis, indicates a close similarity. 2/ US data for 1949 and 1952 are also shown to illustrate changes in such less essential usages as plating, from a controlled wartime economy (1945) to uncontrolled peacetime conditions (1949), and back to controls in 1952. 3/ It is thought that present Soviet practices approximate those of the US in 1952, in that the use of nickel is still being directed primarily toward applications of military significance.

In the US the substitution of more plentiful metals proved to be the most effective conserver of nickel during World War II and the rearmament period during the Korean War. 4/ These measures are also available to the Russians, particularly the increased use of manganese, chrome, and boron, of which they have abundant supplies. 5/

In the US during 1943, about one-third of the 13 million tons of alloy steels were National Emergency Steels containing small amounts of nickel plus various substitutes. 6/ In spite of the saving by this means of an estimated 24,000 tons, about 20 percent of US consumption, consumption increased to a new high of 123,000 tons in the same year. 7/ The urgent demands for Lend-Lease nickel indicate the existence of a similar condition in the USSR.

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* Footnote references in arabic numerals are to sources listed in Appendix E.

** Table 1 follows on p. 3.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

S-E-C-R-E-T

Table 1

Nickel Usages in the US and the USSR

Percent

US				USSR	
	Consumption			Consumption	
Designation	1945	1949	1952	1945	Designation
Ferrous Metals and Alloys					Ferrous Metals and Alloys
Stainless Steels	)	17.4	27.0	27	Nickel-Chrome and Nickel Steels including Stainless
	) 57.7			20	Quality Steel for Automobile-Tractor Industry
Other Steels	)	19.7	18.1	11	Other Steels including Manganese and Acid-Resistant
Cast Iron	3.1	5.0	3.6	4	Castings
Total	60.8	42.1	48.7	62	Total
Nonferrous Metals and Alloys					Nonferrous Metals and Alloys
Copper-Nickel, Nickel-Silver, Brass, and Bronze-Beryllium				12	Copper-Silver
Monel				8	Monel
Inconel and Malleable Nickel				8	Pure Rolled Nickel
Total	27.5	27.6	30.8	28	Total
Electroplating	6.6	21.0	7.1	10	Nickel Plating
High-Temperature and Electrical-Resistant Alloys	4.1	5.9	7.9	N.A.	N.A.
Other	1.0	3.4	5.5		
Total	100.0	100.0	100.0	100	

S-E-C-R-E-T

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

II. USSR.

A. Deposits.*

The most productive nickel deposits in the USSR lie in the Urals Economic Region,** and second are the deposits in the Northwest Region and the East Siberia Region. The important deposits, their location, and the types of ore and their nickel content are given in Table 2.***

The nickel-copper sulfide deposits at Pechenga, which were initially developed during 1935 and 1936 by a subsidiary of the International Nickel Company, are the main source of ore supply for the plant at Pechenga. 8/ Two other nickel-copper sulfide deposits of unknown extent have recently been reported near Pechenga. 9/ The ores in the Pechenga area are difficult to concentrate by flotation and are smelted directly in electric furnaces. 10/

Other important nickel-copper sulfide deposits in the USSR are located near Noril'sk in East Siberia and near Monchegorsk in Murmansk Oblast. The deposits at Noril'sk are for the most part low-grade disseminations and are the source of ore for the nickel refinery at Noril'sk.

In the early thirties, large deposits of sulfide ore containing copper and nickel were discovered on the Kola Peninsula in Murmansk Oblast. During the late thirties, high-grade sulfide ores, containing as much as 4.8 percent nickel, were discovered in the vicinity of Monchegorsk. Both these ores, which are processed in the refinery at Monchegorsk, can be smelted directly in a shaft kiln.

The nickel silicate (garnierite) associated with weathered serpentine represents a large part of the total nickel deposits in the USSR. The majority of these deposits lie in the Central and Southern Urals and are the source of ore supply for the nickel plants in the Urals.

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* See the map, Soviet Bloc: Principal Nickel Deposits and Processing Plants, following p. 22.

** The term region as used in this report refers to the economic regions defined and numbered on CIA Map 12048.1, 9-51 (First Revision, 7-52), USSR: Economic Regions.

*** Table 2 follows on p. 5.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

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Table 2

Principal Nickel Ore Deposits in the USSR 11/

Region and Deposit	Location	Type of Ore	Nickel Content (Percent)	Other Recovered Metals
Northwest				
Monchegorsk	67°55' N - 32°58' E	Sulfide	1.8 to 4.8	Copper and Cobalt
Pechenga	69°20' N - 30°15' E	Sulfide	3.86	Copper and Cobalt
Urals				
Orsk	51°25' N - 58°08' E	Silicate	0.39 to 1.83	Cobalt
Aydyrlinskiy	51°25' N - 59°00' E	Silicate	1.0 to 1.2	Cobalt
Novo-Troitsk (Akkermanovka)	51°15' N - 58°10' E	Silicate	1.0 to 1.2	Cobalt
Rezh	57°25' N - 61°20' E	Silicate	0.8 to 2.5	Copper and Cobalt
Revda	56°48' N - 59°58' E	Silicate	0.8 to 2.5	Copper and Cobalt
Verkhniy Ufaley	56°05' N - 60°15' E	Silicate	0.8 to 2.5	Cobalt
East Siberia				
Noril'sk	69°20' N - 88°06' E	Sulfide	0.3 to 0.9	Copper, Cobalt, and Probably Gold, Silver, and Platinum
Kazakhstan				
Kimpersayskiy	50°50' N - 58°20' E	Silicate	0.3 to 1.6	Cobalt
Buranovo Shelekta	50°40' N - 58°10' E	Silicate	0.3 to 1.6	Cobalt

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Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

In addition to the sulfide and silicate ores, there is one other type of ore which may in the future become an important source of nickel in the USSR. This ore is the nickel-chrome iron ore of the deposits located in the Southern Urals.

B. Reserves.

Proved nickel reserves in the USSR are estimated at a minimum of 800,000 tons, which at the present rate of exploitation would be adequate for about 15 to 20 years.

In 1939 the entire reserves of nickel in the USSR were estimated at 800,000 to 2 million tons. 12/ Based on a total of the individual deposits, the best figure within this range for the year 1939 is believed to be 900,000 tons. The latter figure does not take into consideration the nickel content of the nickel-chrome iron ore deposits in the Southern Urals. Not only Soviet but also worldwide attempts have been made to obtain primary nickel from this type of ore but with little practical success. These ores are used to some extent in the USSR for producing pig iron by direct smelting in the blast furnace. 13/

During 1944 the USSR acquired the large deposits at Pechenga from Finland, which in 1939 had proved reserves of 236,000 tons of nickel. 14/ Total output from this deposit during the period 1939-44 is estimated at 36,000 tons of nickel, making the total Pechenga reserves which were acquired by the USSR equal to 200,000 tons of nickel. These deposits plus the 900,000 tons of proved reserves in 1939 equal a total of 1.1 million tons of proved reserves available to the USSR during the period 1939-53. During the period 1939-53, it is estimated that the USSR produced some 300,000 tons of nickel from the total Soviet reserves. This leaves the USSR with ore reserves containing a minimum total of 800,000 tons of nickel at the present time. The proved nickel reserves in the USSR in 1953 are given in Table 3.* Undoubtedly this figure is low because it is based on proved reserves which existed in 1939 and the deposits at Pechenga acquired in 1944 and therefore does not include discoveries since that date. The USSR has placed great emphasis on geological surveys to find new mineral deposits. In a country as large as the USSR where a large portion is unexplored geologically, there are great possibilities for the discovery of new nickel deposits.

* Table 3 follows on p. 7.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 3

Proved Nickel Reserves in the USSR
1939-53

Region and Deposit [a]	Amount (Thousand Metric Tons)	Nickel Content (Percent)
Northwest		
Monchegorsk [b]	180 [15]	1.8
Pechenga	200	3.86
Urals		
Orsk, Aydyrlinskiy, Novo-Troitsk (Akkermanovka), Rezh	300 [16]	0.39 to 1.83
Revda, Verkhniy Ufaley	100 [17]	0.8 to 2.5
East Siberia		
Noril'sk	200 [18]	0.3 to 0.9
Kazakhstan		
Kimpersayskiy, Buranovo Shelekta	120 [19]	0.3 to 1.6
Total Reserves	1,100	
Production	300 [c]	
Minimum Reserves	800	

a. Deposits were estimated in 1939 at 900,000 metric tons. This estimate did not include the deposit at Pechenga, which was acquired from Finland in 1944.
b. Does not include the high-grade ore (4.8 percent nickel content) discovered near Monchegorsk in the late thirties.
c. Production estimate is a rounded figure taken from Table 5, p. 13, below.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

The Russians have not released any information on nickel reserves since the late thirties other than to state new nickel deposits have been located, such as the new deposits along the Finnish border near Pechenga. 20/ These deposits may be a part of the additional probable reserves located near Pechenga, which were estimated in 1939 at 525,000 tons of nickel. 21/

Based on reports which indicate the discovery of new deposits and the large mineral potential of the USSR, total possible reserves of nickel in ores could be as high as 1.8 million tons.

C. Production. 22/

Stimulated by heavy war industry demand, the USSR is now the second largest nickel producer in the world, being exceeded only by Canada. During the period 1940-53 the USSR continued to develop its nickel deposits and to expand nickel plant capacities. The USSR currently is producing at an estimated rate of 42,000 tons of nickel a year, which is about one-third of Canada's rate, or equal to 40 percent of US imports of nickel.

It is evident that the expansion program will continue since the Soviet press has announced that the 1955 plan for nickel production calls for a 53-percent increase over 1950. In terms of actual output based on 1950 production of 32,000 tons, 1955 planned production is 49,000 tons of nickel.

Refined nickel first was produced in the USSR in 1934 at the plant at Verkhniy Ufaley. This plant continues to process the ore from the deposits in the Central Urals. Before 1934 the USSR was entirely dependent on imports of nickel, a situation which changed only slightly during the late thirties because production at Verkhniy Ufaley was quite small. Current annual production at Verkhniy Ufaley is estimated at 4,500 tons of nickel. It is believed that this plant has undergone very little expansion, since the ore supply in the Central Urals is rather small. In addition to nickel, cobalt is produced as a byproduct at this plant.

By 1939 the USSR had built two additional refineries, one at Orsk and another at Monchegorsk. The initial production at these plants was quite small. Of the 5,000 tons of nickel which were produced in the USSR in 1939, Verkhniy Ufaley produced about 3,500 tons. Plans called for the plants at Orsk and Monchegorsk to be the main producers of primary nickel, each having a maximum capacity of 18,000

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

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to 20,000 tons of nickel a year when completed. 23/ The plant at Monchegorsk was badly damaged by the Germans during World War II, which delayed Soviet plans for expansion until the postwar period. Most of the skilled workers and equipment had been evacuated to Orsk before the bombings, and the plant at Orsk became the principal domestic source of refined nickel for the USSR during the war. With the restoration and expansion of refining capacity at Monchegorsk, these two plants presently produce more than 70 percent of the total nickel output in the USSR.

With the discovery of large nickel deposits in the vicinity of Noril'sk in the 1930's, the Russians began to build a large nickel refinery in this area. The refinery was under construction during 1938-39, in partial operation by 1940, and completed in 1942. In 1943 it was reported that the refinery at Noril'sk produced about one-third of the total nickel output in the USSR, or about 4,000 tons. This production would indicate that the plant was producing considerably below its planned capacity, which was 10,000 tons of nickel per year. The development of the Noril'sk area had been retarded by abnormal climatic conditions and subsequently by lack of shipping vessels during World War II. Postwar progress in this area has been made possible by the supply of convict labor from the nearby MVD camps. In 1950 a double-track, standard-gage railroad was completed from Noril'sk to Dudinka, which is located on the Yenisey River. Three months out of the year, large ocean vessels are able to reach Dudinka by the Northern Sea Route. At the present time there is evidence that a railroad is being constructed from Vorkuta to Igarka and from Igarka to Noril'sk via Dudinka. The construction of such a line will not only offer an alternate route for the exchange of goods between the Arctic section of East Siberia and the industrial regions of the USSR but also will aid the exploration of a vast area believed to be rich in mineral resources. Because of transportation difficulties, exploration has been retarded.

The acquisition of the Pechenga area by the USSR from Finland in 1944 was a major event in the history of the Soviet nickel industry because the USSR acquired both the large nickel deposits in the area and the plant which had been started by the International Nickel Company in 1935. This plant was finally completed under German-Finnish cooperation and was capable of smelting about 10,000 tons of nickel matte a year. During World War II the plant was partially destroyed, but it is now believed to have been completely restored and supplies the nickel refinery at Monchegorsk with nickel matte for refining. The estimated capacity of nickel smelters and the estimated capacity and

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production of nickel refineries in the USSR during 1953 and 1955 are given in Table 4.*

The plants at Monchegorsk, Noril'sk, and Orsk process over 90 percent of the nickel ore of the USSR. Monchegorsk and Noril'sk not only are subject to the rigorous climatic and arduous transportation conditions but also are highly vulnerable from a military aspect. 24/ Monchegorsk is strategically weak because of its proximity to the Finnish border, and Noril'sk, because of the vulnerability of the rail and water transportation route which is open only 3 months of the year. Because of its accessibility to year-round transportation and less vulnerable location, the nickel production at Orsk is probably the most important and most dependable Soviet source of supply.

The estimated nickel production in the USSR for the period 1934 to 1955 is given in Table 5.**

Planned nickel production in the USSR during the period 1950-55 calls for a 53-percent increase over the 1950 production of 32,000 tons, or an increase of 17,000 tons. Distributed evenly over this period the plan could be accomplished by a yearly increase of about 3,000 tons at the existing plants. Expansion of these plants poses no technological problem, and the Soviet heavy machinery industry now is capable of producing the necessary equipment for plant expansion, whereas in earlier expansion periods the USSR had to import foreign equipment. Shipments of ore processing, smelting, and refining equipment during 1949 and 1950 indicate that expansion was taking place at Monchegorsk, Orsk, and Noril'sk. 25/ The Soviet drive for self-sufficiency and their adequate reserves and existing facilities should assure fulfillment of the 1955 planned production of 49,000 tons of nickel.

III. Satellites.

A. Czechoslovakia.

There are several small nickel ore deposits in Czechoslovakia located in the Erzgebirge district of Bohemia and at Ceske Budejovice. 26/ These deposits have been idle for many years.

* Table 4 follows on p. 11.
** Table 5 follows on p. 13.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 :.CIA-RDP79-01093A000500080001-5

Table 4

Estimated Capacity of Nickel Smelters and the Estimated Capacity and Production of Nickel Refineries in the USSR 1953 and 1955.

Metric Tons

Region and Location	Estimated Smelting Capacity (1955)	Estimated Refining Capacity a/* 27/ (1955)	Estimated Production b/ (1953)	Comments
Northwest				
Monchegorsk	N.A.	18,000 to 20,000	15,000	Smelts and refines local ores in addition to matte received from Pechenga. Cobalt is a byproduct.
Pechenga	10,000	0	0	Smelts local ores and ships matte to Monchegorsk for refining.
Urals				
Orsk	N.A.	18,000 to 20,000	15,000	Smelts and refines local ores in the Southern Urals. Cobalt is a byproduct.
Rezh	3,500	0	0	Smelts local ores and ships matte to Verkhniy Ufaley for refining.
Verkhniy Ufaley	N.A.	5,000	4,000	Smelts and refines local ores in addition to matte received from Rezh. Cobalt is a byproduct.

* Footnotes for Table 4 follow on p. 12.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 4

Estimated Capacity of Nickel Smelters and the Estimated Capacity and Production of Nickel Refineries in the USSR
1953 and 1955
(Continued)

Metric Tons

Region and Location	Estimated Smelting Capacity (1955)	Estimated Refining Capacity a/ 27/ (1955)	Estimated Production b/ (1953)	Comments
East Siberia				
Noril'sk	N.A.	10,000	8,000	Smelts and refines local ores. Cobalt is a byproduct.
Total	N.A.	51,000 to 55,000	42,000	

a. Ultimate planned refining capacities. These capacities must be realized by 1955 if the 1955 production goal of 49,000 metric tons of nickel is to be fulfilled.
b. Estimated 1953 production of 42,000 metric tons of nickel was proportionately distributed to the individual plants on the basis of their planned refining capacities for 1955.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 5

Estimated Nickel Production in the USSR
1934-55

Metric Tons

Year	Production	Year	Production
1934 28/	860	1945 32/	15,200
1935 28/	1,055	1946 32/	16,200
1936 28/	2,200	1947 32/	21,000
1937 28/	2,700	1948 32/	25,000
1938 28/	3,000	1949 32/	29,000
1939 29/	5,000	1950 32/	32,000
1940 30/	8,500	1951 a/	35,000
1941 30/	9,000	1952 a/	39,000
1942 31/	11,000	1953 a/	42,000
1943 31/	11,600	1954 a/	45,000
1944 31/	13,000	1955 b/	49,000

a. Production figure is derived by interpolation.
b. Production figure is based on 1955 plan, a 53-percent increase over 1950. 33/

B. East Germany.

The only known nickel ore deposit in East Germany is located at Lichtenstein (Callnberg), near Glauchau, in Saxony. The deposit has been under development since late 1949. The nickel content of the ore reportedly is about 1.2 percent. 34/ The reserves have been estimated to be sufficient for 20 to 30 years of operation. 35/ On the basis of 1955 planned production, these reserves would equal between 30,000 and 45,000 tons of nickel.

The smelting and refining of nickel ore in East Germany are carried out at three plants, located at St. Egidien, Freiberg, and Aue. An ore treatment plant and smelter are under construction at St. Egidien, near the deposit at Lichtenstein. The first furnace of the smelter was scheduled to begin operation in July 1953. Upon completion, the smelter will contain six furnaces. 36/ The smelter will have sufficient capacity to treat some imported ores as well as those

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Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

produced locally. 37/ The nickel matte produced by the smelter at St. Egidien is further processed at Freiberg. Crude nickel from Freiberg is refined electrolytically at the nickel refinery at Aue. In 1952 the plant at Aue had a refining capacity of about 1,000 tons a year, 38/ and it is assumed that this capacity will be increased by 1955.

Nickel reserves of the deposit at Lichtenstein are probably not sufficient to allow for an expansion of production much beyond the planned 1955 level. The possibility exists, however, that additional production can be achieved by importing concentrates and matte, possibly from the USSR. The estimated nickel production in East Germany for the period 1950 to 1955 is given in Table 6.

Table 6

Estimated Nickel Production in East Germany
1950-55

Year	Metric Tons Production
1950 39/	92
1951 40/	110 a/
1952 41/	176 a/
1953 42/	200 a/
1954 43/	560 a/
1955 44/	1,500 a/

a. Plan figure.

C. Poland.

Poland has several deposits of low-grade nickel ore, only one of which is considered to be of industrial significance. This deposit is located at Szklary, in lower Silesia, an area taken under Polish administration in 1945. The nickel content of the ore is 1 percent. In 1947, reserves were reported to be sufficient for 100 years of operation at the prewar rate of exploitation. 45/ This rate would be equivalent to reserves of about 50,000 tons of nickel.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

By 1921 the higher grade ores of the deposit at Szklary were exhausted, and, because of the high cost of processing the lower grade ores, operations ceased. Operations were resumed in 1936 following the development of a more economical process for treating the lower grade ores. The Germans continued these operations until the plant at Szklary was virtually destroyed in the latter stages of World War II. In 1947 the Polish government announced that the plant would be rebuilt and one furnace would be in operation by mid-1948. The 1948 production plan called for 400 tons of nickel. 46/ By 1950 a second furnace was to be in operation. 47/

The current Six Year Plan (1950-55), however, expressed the desire to attain as high a degree of national self-sufficiency as possible. For this reason and because the deposit at Szklary contains the only workable nickel in Poland, it is probable that every effort will be made to maintain the production of the plant at the highest possible level.

The estimated nickel production in Poland for the period 1948 to 1953 is given in Table 7.

Table 7

Estimated Nickel Production in Poland a/
1948-53

Metric Tons

Year	Production
1948 48/	400
1949	440
1950	480
1951	520
1952	560
1953	600 b/

a. Production estimate for 1948 is based on the plan figure. Estimates for 1949, 1950, 1951, and 1952 are derived by interpolation.
b. Production goal of the Six Year Plan was expressed as 50 percent of requirements. 49/ Requirements were reported as 1,200 metric tons of nickel. 50/

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

D. Communist China.

Communist China has two known nickel ore deposits, both located in Sikang Province. The nickel content of the ore ranges from 0.56 to 0.66 percent. Reserves are estimated at about 2,000 tons of nickel. 51/ The nickel content of these ores is too low to be exploited economically, and both mines are believed to be inactive at the present time.

E. North Korea.

There are several nickel ore deposits in North Korea but only three of these deposits seem to be of industrial significance. These deposits are located at Ch'ongam-myon, Ich'on, and Unsong-ni. The nickel content of the ores at Ich'on and Unsong-ni is unusually high, but the reserves are believed to be small. The nickel content of the ores at Ch'ongam-myon is less than 1 percent. 52/

Nickel refining in North Korea was centered at the metals refinery at Hungnam until 1950, when the refinery was at least 90 percent destroyed. 53/ A US Army inspection team that visted the plant in December 1950, when the area was under United Nations control, was able to discern from the ruins that it had been of fairly modern design and structure. Plant records revealed that production of refined nickel was 49 tons in 1948, 55 tons in 1949, and 29 tons in the period from January to August 1950. 54/

There probably has been no nickel production in North Korea since 1950. Future nickel production depends on the refinery at Hungnam being rebuilt and re-equipped. The US Army inspection team recommended that nickel production be expanded to about double the 1949 level. Domestic ores were considered to be sufficient for this purpose.

IV. Soviet Bloc.

A. Trade.

Before and during World War II the USSR imported considerable quantities of nickel from the Western world. These imports amounted to 9,000 tons in 1937, 11,000 tons in 1938, and 1,000 tons in 1939. 55/ Lend-Lease shipments of nickel to the USSR during the war years 1941-45 totaled approximately 22,000 tons plus substantial amounts contained in finished end items such as tanks and planes. 56/ The USSR has had

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

no known nickel imports since 1945 other than such quantities as may have been diverted from the Satellites.

As a result of the rapid expansion of nickel production, the USSR had become a net exporter of nickel to the Soviet Bloc as early as 1948. In 1948 the USSR supplied 986 tons of nickel to Czechoslovakia 57/ and 200 tons to Hungary. 58/ Additional exports were probably made to the other Satellites.

Some nickel is still imported into the Satellites from the West despite the COCOM embargo on nickel which has been in effect since 1951, but it is not possible to determine the amounts. With the recent relaxation of allocation controls in the West, the Satellites will probably now find it easier to procure nickel from non-Soviet Bloc sources in spite of the COCOM embargo.

Numerous instances in which Satellites have expressed a willingness to pay Western sources several times the established world price for nickel is evidence that the USSR often fails to furnish the Satellites with sufficient nickel to meet their demands. Other indications of nickel shortages in the Satellites include measures taken to substitute other metals for nickel and the actual elimination of nickel from certain uses. The estimated nickel imports from all sources by the Satellites for the period 1948 to 1953 is given in Table 8.*

The USSR is the only Soviet Bloc country whose nickel production is high enough to allow exporting, and then only in small quantities, to other countries. Most of the nickel exports go to the industrial Satellites, especially to Czechoslovakia, East Germany, and Poland. A rough estimate of the amounts imported by the Satellites can be made for the year 1953 by assuming that all the imports for that year came from the USSR. Actually this figure could approximate the total imports of nickel by the Satellites because the USSR does supply the Satellites with a major portion of their imported nickel.

As the industrialization of the Satellites progresses, their demands for nickel will increase. Because of limited nickel resources, nickel production as a whole will increase at a slower rate than will the demand, and the Satellites will continue to be dependent on nickel imports. So long as the Satellites are denied access to Western nickel supplies, the increased demands will place an additional burden on the nickel industry of the USSR.

* Table 8 follows on p. 18.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 8

Estimated Nickel Imports by the Satellites a/
1948-53

Metric Tons

Country	1948	1949	1950	1951	1952	1953
Czechoslovakia	1,863 59/	1,760 59/	1,294 59/	N.A.	N.A.	1,980 60/
East Germany	N.A.	400 61/	400 62/	986 63/	1,280 64/	1,709 65/ b/
Hungary	200 66/	200 67/	200 c/	N.A.	N.A.	N.A.
Poland	N.A.	N.A.	N.A.	N.A.	N.A.	600 69/ b/

a. There are no indications that nickel is being imported by Albania, Bulgaria, Communist China, North Korea, and Rumania.
b. Import estimate is based on reported requirements less estimated production.
c. Import estimate is based on reported requirements. 68/

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

In addition to exporting nickel to the Satellites, the USSR has made small shipments of nickel to Finland in exchange for essential equipment and in the latter part of 1953 was offering 500 tons of nickel to West Germany in part payment for 30 trawlers. 70/

B. Stockpiling.

Because of its essentiality, particularly in time of war, there is a strong compulsion on the USSR to stockpile nickel. In 1950 it was reported that two nickel stockpiles existed. 71/ One of these stockpiles, containing 20,000 tons of nickel, was located on the outskirts of Moscow and owned by the Soviet Air Force, and the other, which contained about 800 to 1,000 tons of nickel, was under the control of the Main Administration of State Material Reserves. It is reasonable to assume that other nickel stocks existed in the USSR at that time and are continually being built up.

There is no information available concerning nickel inventories in the Satellites. Since the Satellites, without exception, either produce no nickel at all or at best insufficient quantities for their own requirements, it seems extremely doubtful that Satellite stockpiles exist or that inventories ever exceed normal working levels.

C. Apparent Consumption and Requirements.

In the Satellites, annual consumption approximates the annual available supply, while in the USSR consumption is equal to the production minus exports and additions to the stockpile. Because there is no information available on the amount of nickel stockpiled annually, this stockpiling is included in the amount actually consumed, and the combined entry is labeled apparent consumption. The estimated nickel supply and apparent consumption in the Soviet Bloc during 1953 are given in Table 9.*

An AFOIN estimate of minimum annual wartime requirements (1) to maintain the production of essential military goods during the first year of war, (2) to insure that items in the hands of the armed forces are kept in efficient operation, and (3) to maintain the war-supporting industries and services is given in Table 10.**

* Table 9 follows on p. 20.
** Table 10 follows on p. 21.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 9

Estimated Nickel Supply and Apparent Consumption in the Soviet Bloc a/ 1953

Metric Tons

Country	Production	Exports	Imports	Apparent Consumption b/
USSR	42,000	4,289 c/	0	37,711 d/
Czechoslovakia	0	0	1,980	1,980
East Germany	200	0	1,709	1,909
Poland	600	0	600	1,200
Total	42,800	4,289	4,289	42,800

a. There is no information available on the nickel supply in Albania, Bulgaria, Communist China, Hungary, North Korea, or Rumania.
b. Includes stockpiling.
c. Does not include small amounts shipped outside the Soviet Bloc.
d. It is estimated that 3,850 metric tons of nickel were used to produce MIG-15 and Type 38 airframes and VK-1 and VK-1A engines. Another 400 metric tons are estimated for consumption by the atomic energy program.*

V. Conclusions.

The USSR is endowed with extensive reserves of nickel ores and, if necessity dictates, they have the capability of expanding the rate of extraction.

The intentions of the USSR to stress the development of the nickel industry are evident from the accomplishments of the industry. The USSR has become the world's second largest producer of nickel, and its share of the total world production of nickel has risen from 6 percent to 21 percent during the last 10 years. Relative to the size of its economy, the Soviet nickel supply compares favorably with that of the US.

* CIA estimate.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 10

Estimated Minimum Annual Wartime Requirements of Nickel in the USSR 72/

Metric Tons

Use	Requirements
Military	
Aircraft	16,700
Tanks and Self-Propelling Guns	7,500
Atomic Energy	1,500
Submarines	1,500
Ammunition	500
Total	27,700
War-Supporting Industries	
Machinery and Heavy Equipment	7,300
Electronic and Communications Equipment	800
Scientific and Technical Equipment	700
Transportation Equipment	600
Chemical Uses	600
Miscellaneous	300
Total	10,300
Grand Total	38,000

The Satellites including Communist China produce less nickel than they need. Because of COCOM restrictions, the Satellites are forced to obtain nickel from the USSR, and this dependency causes a drain on Soviet production.

The concentration and location of the major nickel refineries constitute a vulnerability in case of war. One of the refineries is located near the Finnish frontier, and another is north of the Arctic Circle. Thus, as in World War II, the USSR could again be dependent for the most part on the production of the refinery at Orsk.

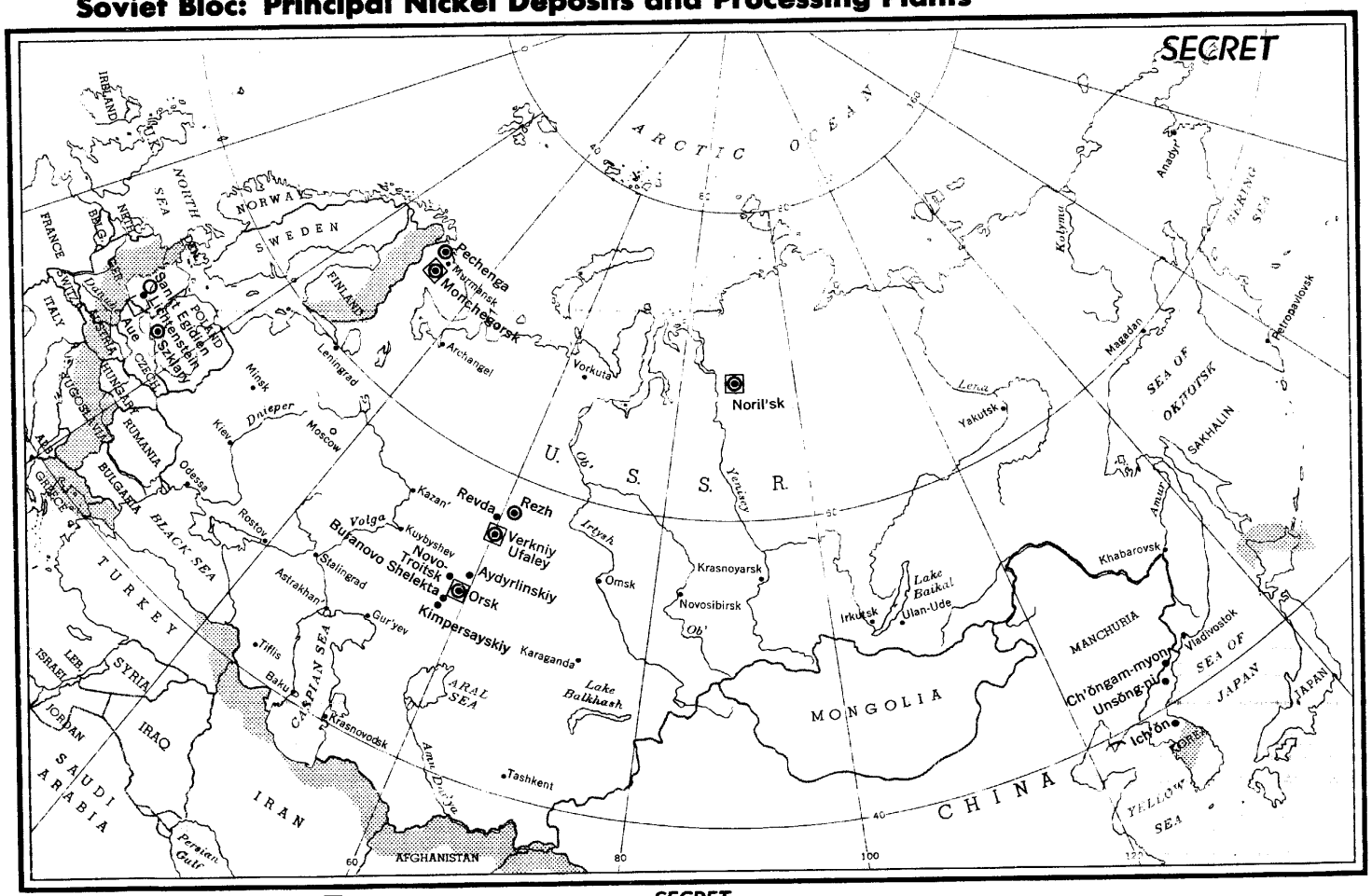
Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Soviet Bloc: Principal Nickel Deposits and Processing Plants



Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

APPENDIX A

INPUTS INTO THE NICKEL INDUSTRY IN THE USSR

1. Energy.

An important input for the nickel industry in the USSR is energy for converting the nickel ores into metal. The source of energy in the USSR will be electric power or coal, depending on the location of the mines, smelters, and refineries. The 1955 planned production of 49,000 tons of nickel will require 495 x 10^{10} British thermal units (Btu)* of energy, divided among ore mining, smelting, and refining, as follows:

a. Ore Mining.

The energy required for the extraction and preparation of 1 ton of ore is 67,000 Btu. 73/ Based on an estimated average recovery of nickel equal to 1.7 percent of the mined ore, 2.9 million tons of ore will be required to supply the 1955 plan of 49,000 tons of nickel. The energy requirement for this mining is 19 x 10^{10} Btu (29 x 10^5 tons x 67 x 10^3 Btu).

b. Smelting. 74/

The smelting of ore in the electric furnaces at Pechenga during the first year of operation required 89 x 10^6 Btu. This same factor is used for all smelting operations because it is believed to be representative of the energy required to smelt nickel ores of any composition. The estimated energy requirements of the nickel smelting plants in the USSR to fulfill the 1955 planned production are given in Table 11.**

c. Refining.

Nickel is usually refined electrolytically, and the process requires 3,757 Btu per pound of nickel. 75/ On this basis, the 1955 planned production will require 41 x 10^{10} Btu (2,205 pounds x 49,000 tons x 3,757 Btu).

* A British thermal unit (Btu) is the quantity of heat required to raise 1 pound of water 1 degree Fahrenheit.

** Table 11 follows on p. 24.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Table 11

Estimated Energy Requirements of the Nickel Smelting Plants in the USSR 1955 Plan

Region and Location	Type of Smelting	Estimated Annual Capacity (Metric Tons)	Energy		
			Requirement (Btu)	Type	Source
Northwest					
Monchegorsk	Electric	10,000	89×10^{10}	Hydro-electric	Kandalaksho
Pechenga	Electric	10,000	89×10^{10}	Hydro-electric	Janiskoski
Urals					
Orsk	Electric	20,000	178×10^{10}	Coal	Orsk Thermal-electric Power Plant
Verkhniy Ufaley a/	Coal and Electric	5,000	44×10^{10}	Coal	Sverdlovsk-Chelyabinsk Power Network
East Siberia					
Noril'sk	Coal and Electric	10,000	89×10^{10}	Coal	Noril'sk Power Plant
Total		55,000	489×10^{10} b/		

a. Included is the requirement of the plant at Rezh.
b. Total estimated capacity for 1955 is 55,000 metric tons of nickel, and 1955 planned production is estimated at 49,000 tons. The smelters therefore will be operating at 89 percent capacity, using 435×10^{10} Btu.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

2. Labor.

An AFOIN estimate of the labor force at nickel smelters and refineries in the USSR is given in Table 12.

Table 12

Estimated Labor Force at Nickel Smelters and Refineries in the USSR a/ 76/
/As of 1 January 1954/

Region and Location	Skilled and Managerial	Semiskilled and Unskilled	Total
Northwest			
Monchegorsk	435	2,465	2,900
Pechenga	150	850	1,000
Urals			
Orsk	375	2,125	2,500
Rezh	30	170	200
Verkhniy Ufaley	195	1,105	1,300
East Siberia			
Noril'sk	375	2,125	2,500
Total	1,560	8,840	10,400

a. Does not include workers involved in mining nickel ores.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

APPENDIX B

WORLD NICKEL PRODUCTION 1943 AND 1953

Table 13

Country	1943 a/ Production (Metric Tons)	1943 a/ Percent	1953 b/ Production (Metric Tons)	1953 b/ Percent
Canada	130,642	78.2	129,000	65.5
Cuba	2,430	1.5	12,700	6.4
New Caledonia	7,374	4.4	10,900	5.5
Union of South Africa	343	0.2	1,200	0.6
US	582	0.3	600	0.3
Finland	8,970 c/	5.4	N.A.	N.A.
USSR d/	11,160	6.6	42,000	21.3
East Germany			200	0.1
Poland			600	0.3
All Other	5,626	3.4		
Total	167,127	100.0	197,200	100.0

a. Bureau of Mines estimate of peak production during World War II.
b. Bureau of Mines preliminary estimate.
c. Since 1944, the production from the deposit at Pechenga has been included in the Soviet production estimates.
d. CIA estimates.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

APPENDIX C

METHODOLOGY

1. Reserves.

The method of arriving at the amount of proved nickel reserves in the USSR is explained in II, B, above. Because of the lack of information, it was not possible to estimate the total reserves at the present time. It is believed, however, that the minimum figure of reserves, 800,000 tons, is a reasonable estimate which indicates the magnitude of nickel reserves in the USSR and can be used in making certain observations regarding the nickel supply in the USSR.

2. Production.

Production estimates which are given in this report have been based largely on reported annual increases in production expressed in percent. For the early years, 1934 to 1939, there were semiofficial data available, such as those put out by the American-Russian Chamber of Commerce in 1939. The year 1940 is the base year to which the percentage figures were applied, and 1940 nickel production was estimated by various sources between 8,500 and 8,650 tons. Production figures during the years 1941 and 1942 are estimates based on available plant capacity. The 1943 production was reported to have been 129 percent of the 1940 production, and 1945 production 176 percent of 1940 production. The 1944 production is an estimate obtained by interpolation. During 1946, production was reported to have increased 6.5 percent over that of the preceding year, while 1947 production is based on a 30-percent increase over the 1946 production. During 1950, production was reported to have been 32,000 tons. The production of the intervening years between 1947 and 1950 was obtained by interpolation, as was the production for the years 1951 to 1954. The latter interpolation figures were based on Soviet plans to increase production in 1955 to 153 percent of the 1950 production.

Information available on plant capacities and data from other intelligence sources have been used in conjunction with the reported percentage increases to test their reliability. It is felt that these estimates are close to the actual production.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

APPENDIX D

GAPS IN INTELLIGENCE

Although it is felt that the intelligence information contained in this report is in most respects reliable, many significant deficiencies are evident.

Little direct post-World War II information pertaining to the specific capacities of the various nickel processing plants in the Soviet Bloc is available. This deficiency is especially true of the plants at Noril'sk, Orsk, Verkhniy Ufaley, and Pechenga in the USSR; at Szklary in Poland; and at Aue in East Germany. Information before 1949 is better on Monchegorsk, but it is by no means complete. Details concerning developments since 1949 are almost completely lacking. The most serious gap in intelligence information regarding the various combines is the postwar expansion of smelting and refining capacity. For example, it is not known definitely whether or not a refinery has been built at Pechenga.

Gaps in intelligence also exist on developments in ore processing practices and techniques. Specifically, it would be of advantage to know what measures have been taken to exploit more fully the relatively large deposits of complex nickel-bearing ores in the Southern Urals. More information is desired on the methods and processes of treating the low-grade ores of Poland and East Germany.

Soviet Bloc trade statistics on nickel are weak. More complete information is needed on the nickel imports to the Satellites from both the West and the USSR.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

APPENDIX E

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

The most valuable sources for data on nickel for the USSR are the following:

a. NIS 26, Section 63. This report is believed to be quite reliable. It has made considerable use of captured German intelligence documents.

b. Bureau of Mines, Materials Survey - Nickel. This valuable report, prepared for the National Security Resources Board, described types and locations of nickel ore deposits in the USSR and was part of the basis for Soviet estimates.

c. Bureau of Mines, Minerals Yearbook. This book was used as part of the basis for the Soviet estimates.

d. Dimitri B. Shimkin, Minerals: A Key to Soviet Power. This book is a comprehensive report on the minerals situation in the USSR, and the figures on nickel are considered reasonable. This source was used as background material only.

e. John Scott, Heavy Industry in the Soviet Union East of the Volga. This book is considered to be an excellent source of information on ore deposits, ore reserves, and descriptions of plants in the USSR.

f. Information from captured German intelligence documents was used extensively in establishing basic facts about the nickel industry in the USSR.

g. The CIA documents were the most important sources of data on the nickel industry in the Satellites -- for instance, NIS 18 provided good information on Czechoslovakia.

h. State Department despatches provided a limited amount of information.

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

Approved For Release 1999/09/02 : CIA-RDP79-01093A000500080001-5

2. Sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
A - Completely reliable	Doc. - Documentary
B - Usually reliable	1 - Confirmed by other sources
C - Fairly reliable	2 - Probably true
D - Not usually reliable	3 - Possibly true
E - Not reliable	4 - Doubtful
F - Cannot be judged	5 - Probably false
	6 - Cannot be judged

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which will carry the field evaluation "Documentary" instead of a numerical grade.

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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1. Rand, RM-1030, Prices of Non-ferrous Metals in the Soviet Union, 1928 to 1950, 21 Jan 1953. U. Eval. A-Doc.
2. Bureau of Mines, Mineral Yearbook, 1949, p. 3. Eval. A-Doc.
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6.

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7. US Senate, op. cit.

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9. Bureau of Mines, Materials Survey - Nickel, 15 Apr 1952. U. Eval. RR B-2.

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11. Ibid.

25X1A [redacted]

12.

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25X1A2g 14. [redacted]

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25X1A2g 21. [redacted]

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25X1A [redacted]

28. Scott, op. cit.
29. NIS 26, op. cit.

25X1X7 30. [redacted]

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25X1X7 33. [redacted]

25X1A 34. [redacted]

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36. [redacted]
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45. [redacted]
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60. CIA FDD, Weekly Report, 1/50, 10 Jan 1950. S. Eval. RR B-3.

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